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AUTHOR	Belfield, Clive R.
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ABSTRACT

This paper estimates the effects of state-imposed curriculum mandates on the test scores of public-school students who took the SAT in 2001. By 1998, 14 states had mandates that high-school students should take an economics course. For these states, the proportion of public-school students taking high-school economics was around twice that of states without mandates. The mandate may be interpreted as a regulation on input use in the education sector, potentially impairing the efficiency of schools. It is hypothesized that where there is a mandate, test scores should be lower. The merit of the mandate on scores can be assessed empirically. Using microlevel data on a large sample of students across the United States, this inquiry tests whether students' academic performances are higher or lower in states where there are mandates. This test offers a direct evaluation of the efficiency of the mandate. The mandate reduces test scores by as much as 0.25 standard deviations for those students who would not otherwise have enrolled. This paper sets out the theoretical explanation from the imposition of a mandate, describes the dataset, sets out the estimation method, and reports the results. (Contains 6 tables and 24 references.) (Author/WFA)

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National Center for the Study of Privatization in Education
Teachers College, Columbia University

Should the curriculum be set by state fiat?

An empirical test using Economics courses in High School

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Clive R. Belfield
cb2001@columbia.edu
Teachers College, Columbia University,
525 W.120th Street,
New York, NY 10027-6696

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Abstract This paper estimates the effect of state-imposed curriculum mandates on the test scores of public school students who took the SAT in 2001. By 1998, 14 states across the U.S. had mandates that high school students should take an Economics course. For these states, the proportions of public schools students taking High School Economics was around twice that compared to those in states without mandates. The mandate may be interpreted as a regulation on input use in the education sector, potentially impairing the efficiency of schools. Where there is a mandate, test scores should be lower. Using a range of estimation techniques, students who are mandated to take Economics post substantially lower SAT scores. The mandate reduces test scores by as much as 0.25 standard deviations for those students who would not otherwise have enrolled. Such effects are not found for three other subjects: French, German, and Biology.

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National Center for the Study of Privatization in Education
Box 181, Teachers College,
525 W. 120th Street,
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I. INTRODUCTION

Should the high school curriculum be set by state fiat? In some cases, it is: By 1998, 14 states required that students take at least one Economics class in high school. The aim is to make high school education more 'Economics-friendly', and generally enhance students' understanding of capitalism, markets, and business.[1] By 1998, national education standards for elementary and secondary schools had been prescribed across 9 other subjects (Buckles and Watts, 1997), and Federal legislation (Leave No Child Behind, 2001) emphasizes clearer learning standards across the states. These reforms are aimed at a nationwide specification of the high school curriculum as a set of standards; when adopted by states, they in effect mandate what subjects students can learn at school.

However, such curriculum mandates may not be efficient. This is especially likely where the subject is infrequently chosen by many students and is often regarded as uninteresting or difficult, a description probably applicable to Economics (more so, say, than History or Geography, see Walstad, 1992, 2019). Some students will benefit from such mandates, particularly if Economics is more rigorous than the courses they would otherwise have chosen, but others will not benefit from being forced to take a class which they neither want nor need. Ironically, Economists (perhaps to a greater degree than scholars in any other discipline) would assume that students and parents are capable of making optimal subject choices at school, and that a mandate favoring one subject would

[1] The vision of the National Council on Economic Education is for: "A nation of people who have the knowledge, understanding and skills to make informed economic choices"; "Students who possess economic ways of thinking and problem-solving that they can use in their lives as responsible consumers, producers, savers and investors, and effective participants in a global economy"; and "Employees who understand economic concepts and economic ways of thinking and are better able to make informed decisions in their personal finance, in the workplace and as citizens" (www.ncee.net).

not be necessary. Instead, the mandate would be anticipated to act as a market distortion, imposing deadweight losses on the affected students. In rebuttal, it may be argued that young students are not capable of choosing courses that are most useful to them (because of information-gathering costs for example), and so curriculum mandates should be set down by more knowledgeable professionals in the education industry. If this is the case, the academic performance of these students should be enhanced by the mandate. An alternative rebuttal is that students should be forced to take Economics classes because these classes convey the greatest externalities for the rest of society or because they help with financial management skills. Under this reasoning, the academic performance of the Economics students would be lower (or perhaps unchanged), but their enrollment choices would be socially optimal.

The merit of the mandate on scores can therefore be assessed empirically. Using micro-level data on a large sample of students across the U.S., this inquiry tests whether students' academic performances are higher or lower, in states where there are mandates. This test offers a direct evaluation of the efficiency of the mandate. Section 2 sets out the theoretical expectation from the imposition of a mandate. Section 3 describes the dataset. Section 4 sets out the estimation method and reports the results. Section 5 offers some conclusions.

II. THE ECONOMICS OF CURRICULUM MANDATES

There are two ways to understand a curriculum mandate. One is to see it as influencing what students learn, and tracing the private and social consequences. So, Bernheim et al. (2001) find that savings patterns and accumulated wealth are positively influenced by the mandate to study consumer/financial concepts in high school. A mandate may therefore be justifiable, assuming that savings rates are initially suboptimal. For the purposes of analysis in this case, however, a curriculum mandate is taken as a regulation influencing the firm's technology: schools must include Economics in their curriculum, and students must enrol. In the education sector, technologies are normally specified with academic outcomes as the output and with inputs identified as: school resources (for example, teachers, instructional materials, and curriculum content); student effort (for example, time on task, engagement in class); and family/home resources (on education production functions, see Hanushek, 1995). Those who gain from the mandate are therefore the suppliers of required services (for example, Economics teachers) and, if enrollments across subjects are path-dependent, Economics Professors at colleges and universities.[2] However, through two routes, the mandate will affect the productivity of two key inputs: school resources and student effort. Where productivity is impaired by the mandate, efficiency and so test score outputs will be lower.

The mandate will reduce the productivity of teachers if the quality of instruction in mandatory Economics classes is lower than the average instructional quality. This is

[2] The hourly earnings of Economics teachers are the third highest – behind airline pilots and physicians – across all professional occupations and higher than those of teachers in any other discipline (National Compensation Survey, 2000, www.bls.gov/ncs/ocs/sp/ncar0002.pdf). On the path-dependency of students' subject choices, see Buckles and Morton (1988); for a discussion of the numbers and characteristics of students taking Economics in higher education, see Salemi and Siegfried (1999).

likely. The mandate should raise the demand for teachers with some Economics training. But, extra supply will not be forthcoming where teachers' pay is set uniformly across subjects (Lankford et al., 2002), particularly where teachers with Economics training receive above average offers to work outside teaching (or, in the short run, where the teacher training market fails to adjust, see Ballou, 1996). The likely result is that the mandate will in part be met by hiring teachers with below-average training in Economics, and so the quality of instruction will fall. So, Baumol and Highsmith (1988, 260) found "the number of relatively untrained teachers [in Economics] is quite large, with 25 percent of the high school economics teachers have accumulated *less than* 6 semester or quarter hours of course credits in the field" (emphasis in original, see also Walstad, 1992, 2037-39). Of course, non-mandate states will also find it harder to hire Economics teachers (especially if teachers are mobile across states), such that the quality of instruction in Economics may fall across all states.

However, the mandate will raise the productivity of school resources under two conditions. One is if the curriculum content of Economics courses is more effective/rigorous than that of the average course (on the correlation between taking Economics and Economic literacy, see Lillydahl, 1990; Bach and Saunders, 1965; on the above-average ability of Economics students, see Buckles and Morton, 1988). The second condition is where there is (implicitly) some barrier dissuading students who could pass such a course from taking it. Bishop (1996), for example, suggests there are negative peer pressures to study hard and that student effort is generally low. Of course, it is possible to believe that Economics has above-average rigor without presuming that it

should be mandatory. Some proportion of students may indeed be better off by being forced to take Economics, but that proportion is unlikely to be 100 percent.

The productivity of other school resources may also be influenced by the mandate. These disciplinary content standards are promoted as public goods: they are non-rivalrous in consumption, easy to access, and with high fixed costs but low variable costs (as argued by Siegfried and Meszaros, 1998). However, a mandate set down with a national generic curriculum and content standards is unlikely to be appropriate for all student groups, even where those groups need Economics courses. So, a curriculum including the Economics of rent control is interesting to high school students in Manhattan, New York, but the Economics of agricultural subsidies may be of more interest in Madison, Wisconsin. Indeed, almost as soon as any standards are set down their legitimacy is questioned and criticisms are raised (see Walstad, 1992, 2033-35). As well, to make the Economics content palatable to all students, it may be watered down to include topics such as budgetting or balancing a checkbook. Thus, content standards may need to be revised for each local circumstance and heavily tailored to fit with the teacher's own training and competency as well as the students' abilities.

More clearly, a mandate is likely to reduce the productivity of student inputs, by reducing the effort and classroom engagement of students. This reduction is likely to arise because students are forced to take Economics rather than free to take it. Freedom of choice is often associated with value: people prefer things they have chosen themselves (albeit in part through positive reinforcement). All that is needed to predict the impact on student effort is to assume heterogeneous preferences across subjects: if Economics is not strictly preferred by 100% of students, some enrollees will be

dissatisfied. Indeed, Baumol and Highsmith (1988, 261) found 13% of students disliking Economics either a little or a lot. Being mandatory, Economics classes sacrifice an important stimulus to students' engagement to learn.[3] However, it is possible that losses in student effort can be regained if performance in an Economics class is assessed such that there are real penalties/rewards from studying (see Bishop, 1997). Yet, it seems unlikely that Economics classes are assessed more rigorously than the average course. It is also possible that students face substantial menu costs to enrollment across subjects, and a mandate eliminates those costs. Here, however, it may be asked why schools or districts cannot impose their own mandates (or slimmer menus), rather than have one imposed upon them.

The effect of the mandate on students can be traced using standard time-allocation optimization models (Bacdayan, 1994). Students should allocate their time optimally across all subjects, such that the returns to each one are equalized. Controlling for exogenous characteristics, and in particular prior ability, this equivalence should be observable. But curriculum mandates clearly interfere with this optimality condition. Therefore, a curriculum mandate is anticipated – both through its effect on the quality of instruction and student effort – to reduce student test scores. However, simple economic notions of diminishing marginal returns would imply that where a higher fraction of students (as inputs) take Economics, the returns to Economics will be reduced. So, a

[3] It is also possible that students who are genuinely interested in Economics are adversely affected in class by students who are genuinely not interested. As well, students who wish to major in Economics at university may need to differentiate themselves from other students. To do so in a mandate state would require taking additional credits in Economics, where these additional credits have sub-optimal marginal productivity. It is possible, therefore, that the students who prefer Economics are more adversely affected than the students who are not interested.

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strict test is whether the returns are negative in the mandate states, not simply lower than in the non-mandate states.

Notwithstanding any economic theory, column 1 of Table 1 lists 14 states where enrollment in at least one Economics class is mandated. These states are spread across the US, and the mandates were introduced at different times (see www.ncee.net).[4] Some of these states have low-regulation mandates: 4 do not require inservice relicensure of their teachers, and 5 do not require students to take curriculum-relevant tests in grade 10 or higher. These low-regulation mandates are anticipated to generate all the benefits of a mandate, including enrollment effects, but also to have additional distortionary effects. Without relicensing, it is easier to allocate teachers without a background in Economics to teach the Economics classes. The distortionary effects of the mandate are increased by greater reductions in the quality of instruction in Economics. Without testing, uninterested students can devote minimal effort to study, thus impairing any general skills they might obtain from their Economics classes. Again, the distortionary effect is bigger. Therefore, the effects of the mandate are investigated, but with a supplementary focus on those states with low-regulation mandates where the distortionary effects might be greatest.

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[4] The mandates arose from the Recommendations of the 1961 National Task Force on Economic Education (see Walstad, 1992, Table 1). Identifying mandate states may be subject to some measurement error: some states mandate a course in Business Education and others favor infusing the general curriculum with Economics. States listed in Table 1 – taken from the National Council on Economic Education (NCEE) – are not exactly those in Bernheim et al. (2001) or Walstad (1992). Partly, this is explained by: changes in mandate status over the 1990s; the different Economics courses that are mandated – here only discrete Economics courses (not personal finance) are counted; and identification as only where enrollment is required (rather than where Economics must be offered). NCEE reviewed all Economics curricula in 1998, to give up-to-date information. But, three states may be classified either way. Indiana requires Economics for college-preparatory students (applicable to the dataset used here); New Hampshire strongly infuses the curriculum with Economics; and in Massachusetts the course must "count" as Economics. The first two (IN and NH) are included as mandate states, but the last (MA) is not. However, when the reverse classification is used (excluding IN and NH, including MA), the results are not materially affected.

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III. SAT TEST DATA

The SAT test data are taken from the databank of ETS and the College Board. The dataset is the entire sample of SAT test-takers in 2001, although for this analysis the sample is restricted to only those students in U.S. public schools, aged between 16 and 19. Thus, the analysis is of the effect of the mandate on high-achieving students, not the average student (although there is no presumption that the effect will be larger or smaller across the distributions of student ability). The sample is extremely large at 596,559, with detailed personal characteristics for gender, ethnicity, citizenship, family education levels, and pre-test High School GPA score. In their pre-test questionnaire, students report how much Economics (along with the other subjects) they took. The data indicates whether the students took 0, 0.5, 1, 2-3 or 4+ years in Economics, and whether or not the student is in the Economics honors program.[5]

Table 2 contrasts the characteristics of students who have taken any classes in Economics with those who have not. Male students are more likely to take Economics (perhaps explaining why more males "think like Economists", Caplan, 2001; for a thorough investigation of adults' Economic knowledge, see Walstad and Saunders, 2002). Notably, Economics students report higher GPA grades, consistent with the idea that Economics is a 'tough course' requiring ability above the mean. However, the SAT

[5] A sizeable proportion of the test-takers report neither their GPA score nor full information on their High School curriculum. However, when GPA score is excluded from the analysis and when missing High School curriculum data is interpreted as 'no Economics', the conclusions drawn below are not materially affected. Furthermore, the results are also similar for private school students, although – as expected – the mandate does not raise enrollments in Economics as high for the private sector compared to the public sector.

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scores of Economics students are fractionally lower, by 0.015 standard deviations. This initial discongruity – higher ability, lower test scores – is suggestive.

Table 3 shows the effect of the mandate on enrollment at High School across Economics and three other subjects (see also Bernheim et al., 2001).[6] Not every student in mandate states will have taken Economics: some may have obtained exemptions and others may still have to enrol; others may have moved into a mandate state during High School; for some, Economics may be part of a general curriculum program which may not be titled 'Economics' (or even recognizable as Economics). Nevertheless, the mandate has a strong effect, particularly when compared with enrollments in French, German, and Biology. Whereas 39.05% of students in non-mandate states have taken any Economics in high school, the respective figure for the mandate states is 81.94%. The effect is particularly striking for students taking a half-year one course credit in Economics, suggesting that many schools are just meeting the mandate threshold. Enrollments in Economics are also substantially higher than the 29% of high school graduates in 1987 (Walstad, 1992, Table 2). Overall, the mandate raises the amount of Economics enrollment by approximately double, with each of the other subjects displaced slightly; one-quarter of all U.S. public school students are enrolled beyond the margin. The mandate boosts Honors programs in Economics almost by a factor of three, suggesting that it encourages students to major in Economics. However, at issue is whether the test scores for these students are impaired by the mandate.

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[6] French, German, and Biology were chosen because – at least *a priori* – they are unlikely to be directly displaced by the mandate (and so should avoid showing the effect of the mandate in reverse, so to speak). They also vary in the extent to which they are part of a core High School curriculum, i.e. subject to a mandate of their own.

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IV. ESTIMATION MODEL AND RESULTS

A. Estimation Model

The estimation begins by applying Ordinary Least Squares estimation to identify the effects of Economics (*ECON*) on total SAT test scores (*SAT*), adjusting for a set of control variables (**Z**):

(1) $SAT = a + bECON + c\mathbf{Z}$

The average SAT score for these public school students is 1019, and the standard deviation is 203. Divided by 0.02, therefore, the coefficient *b* approximates to the effect size of enrollment in Economics on an individuals' SAT score. For exposition, three versions of *ECON* are used: whether the student has undertaken any study; dividing credit loads into 0.5 years, i.e. one course, or more (the majority of whom have taken just one year); and whether the students is on the Honors program. Included in **Z** are a set of personal characteristics and family education levels.

Interpretation of the coefficients for *b* must be carefully performed. Strictly, the aim is to identify whether the mandate conveys benefits to or imposes costs on students who otherwise would not have freely chosen to enroll in Economics. However, Economics is often thought to be a 'tough' course at school, and so those who enroll may be a selected group of high ability students. Thus, *b* is anticipated to be positive where students are free to choose their courses, because of omitted variable bias. Controlling for prior ability helps address this problem in general (although perhaps insufficiently for the Honors students). More formally, the effect of the mandate is to force students to enroll: it therefore serves as an instrumental variable identifying exogenous enrollment in

Economics, uncorrelated with the omitted ability variable and other differences, for example, in students' preferences across subjects.[7] The mandate is probably independent of individuals' preferences: it is set at the state level (so changing residence would be very costly); and even if the mandate is voted for, it is then only endogenous to voters' preferences which are not the same as the students. Therefore, equation (1) is also estimated using as an instrument residence in a state with a mandate.

An alternative approach is also applied, with estimation of:

(2) $SAT = a + b_1 ECON + b_2 ECON*MANDATE + c\mathbf{Z}$

The interaction term *ECON*MANDATE* will give the additional effect of Economics where the student lives in a state with a mandate. Both the instrumental variables estimation and the interaction models are also applied where the mandate is restricted to the eight low-regulation states. The effects of the mandate should be more pronounced in these states.

A final analysis uses the interaction model and compares the SAT premium for Economics against the other non-core subjects of French, German, and Biology. If students are choosing subjects optimally, then there should be no effect – controlling for ability – in the effects of individual subjects on SAT scores. However, where there is a mandate, stronger effects across subjects should be identifiable and these effects may apply to students in both mandate and non-mandate states.

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[7] Instrumental variables may raise as many concerns as they solve (for a general discussion of the properties of instrumental variables in large samples, see Bound et al., 1995; Angrist and Krueger, 2001). In a similar context, Bernheim et al. (2001) reject the use of instrumental variables for the imposition of the mandate. One of their reasons for rejection – the use of time-series data – is clearly not applicable here; the other reason – recollection error by the respondents – is also less relevant to this analysis because the SAT respondents are asked to specify all the courses they are currently taking.

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B. Results

Controlling for a set of exogenous personal characteristics but not student ability, the top panel of Table 4 shows that enrollment in Economics is associated with higher SAT scores. (All the other personal characteristics show plausible relationships, with details available from the author). The effect of taking any Economics is about 0.015 standard deviations, with a large effect of 0.6 standard deviations for Honors students; but there appears to be a negative effect for students taking more than one year of Economics. Again, this is suggestive of a distortion. Overall, it is plausible to assume that students who choose Economics courses are gaining an advantage from taking a course with above-median rigor.

Controlling for prior ability, the bottom panel of Table 4 shows the negative effect of taking Economics on SAT test scores: these students post scores which are 0.03 standard deviations lower than the average public school student. Plausibly, those who only take a small amount of Economics suffer less than those who take at least one year of Economics. Students in Honors Economics still post much higher scores, up to .3 standard deviations; but, this may result from incomplete specification of ability in the estimations. Introducing ability substantially improves the goodness of fit of the model (the R-squared for row 4 is 0.46), and it is retained in subsequent estimations.

The top panel of Table 5 reports the instrumental variable estimations.[8] The results – applying the instrument to each specification of Economics – are striking. For those students exogenously forced to enroll in Economics, SAT scores are substantially

[8] A Hausman test clearly rejects the null hypothesis that the difference in coefficients is not systematic, $?^2(1)=1213.87$; so OLS estimation is inconsistent. The mandate is – as evident from Table 3 – highly correlated with the enrollment in Economics courses. Although two-stage least squares estimation does inflate the standard errors, given the sample size of 596,599 the main concern is with Type II rather than Type I errors.

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lower. If the mandate influences all students' enrollment in Economics (row 1), the effect is to reduce SAT scores by 0.22 standard deviations. For those influenced to take Honors programs in Economics, the effect size on SAT scores is -0.85 (an effect larger than either racial gaps or differences in parental education). These results suggest that the mandate generates a substantial distortion, at least for the individuals marginally induced to take Economics.

The bottom panel of Table 5 reports the interaction models. In general, Economics courses have a positive effect on SAT scores, although the effect size is small at 0.03. However, the interaction term shows that there is a penalty for mandated enrollment in Economics, with a net lower SAT score by 11 points (0.05 standard deviations). Similar results are found with interactions across course loads, with mandatory enrollment offsetting any benefits from the curriculum content of Economics. There also appears to be a penalty when the interaction is applied to the Honors students; although here the net effect of enrollment in Honors Economics is positive for those in mandate states, their premium is only two-thirds of that of students who are not subject to the mandate.

The righthand columns of Table 5 report results for the eight low-regulation mandate states (i.e., with weak relicensing or student assessment). Plausibly, there is a greater adverse effect when the mandate is accompanied either by weak relicensing systems or less intensive student assessment.

Table 6 compares the returns to taking Economics, compared to other subjects, in a single OLS estimation. Clearly, the premium to taking Economics is much lower than that for French, German, or Biology (from inspection, students who post lower scores are

taking more basic Math and English courses); the premium is around one-fifth of the average elective subject premium. Morevoer, the subject effect in the mandate states is such that for Economics test scores are reduced by 0.035 standard deviations. For the other subjects the state effects do show lower test scores in mandate states, but the effect is not sufficiently strong as to outweight the direct subject effect. So, it appears that Economics is the subject most affected by the mandate, and SAT scores are negatively affected.

V. CONCLUSIONS

A mandate to take certain High School courses may be efficient: it may simplify menu costs for students, or introduce the more accurate information of education professionals into the curriculum. Economics may supplant other less rigorous courses that – through peer pressure, indolence, or ignorance – students would have independently chosen. If these arguments are valid, students in states where Economics is mandatory should post higher academic outcomes.

This hypothesis is tested here. The outcome measures used are the SAT scores of a large sample of public school students. Although standardized tests are heavily criticized for their validity (Vars and Bowen, 1998), students expend considerable effort -- and pay sizeable tutoring fees – to maximize their SAT scores. In many cases, their college aspirations hinge on posting a high score. Moreover, unlike many other academic tests, the SAT has a reasonably clear economic value: attending a college where SAT

scores are 1 standard deviation higher than the average raises earnings by between 3%–7% (Hilmer, 2000).

The evidence here suggests that a curriculum mandate to enroll in at least one Economics course sharply raises the numbers of students taking Economics. There may be substantial social benefits if Economics conveys greater externalities than the subjects students would have otherwise chosen (as indicated by Bernheim et al., 2001). Nevertheless, the mandate reduces the SAT performances of the affected students, leading to a strong rejection of the above hypothesis.

There are two ways to estimate the substantive significance of this effect on SAT scores. These are outlined here, using conservative assumptions throughout. First, the effects on student earnings can be estimated. Applied across all students in the mandate states, SAT scores are 0.05 standard deviations lower, and so future earnings would be 0.15% lower. At the margin, the mandate reduces test scores by 0.22 standard deviations for the extra one-quarter of enrollees and so reduces their subsequent earnings by 0.66%. This is around 10 percent of the typical returns to an additional year of education (Ashenfelter and Rouse, 1998), or equivalent to having a father with a college education instead of High School. It is almost one-quarter of the gap between African-American and white students. Second, the effect can be estimated in relation to per-pupil expenditures in public schools. At aged 16, the net present value of 0.66% of post-college earnings for the working years aged 22 to 32 is approximately $700-$9000. This is around 10% of the average annual per pupil expenditure in public schools, suggesting the mandate imposes a sizeable distortion on both the technologies of schools and the private gains from study. These costs are non-trivial and should be factored in when

claims are made about the efficiency and effectiveness of curriculum mandates for U.S. schools.

Table 1
States Where Enrollment in At Least One Economics Class is Mandated

States with Mandates Enrollment is Required*	Inservice Requirement for Relicensure	Student Testing in Grades 10 or Higher
GA	Yes	Yes
IN	Yes	Yes
NH	Yes	Yes
NV	Yes	Yes
NY	Yes	Yes
TN	Yes	Yes
FL	Yes	No
NC	Yes	No
SC	Yes	No
ID	Yes	No
AL	No	Yes
CA	No	Yes
LA	No	Yes
TX	No	No

Source: Status of Economic Education in the States, 1998. www.ncee.net. *Some states require a course in Economics to be offered.

Table 2
Characteristics of Students by Years of Enrollment in Economics

	Any years of Economics	No Economics
Male	41.61%	40.27%
GPA score: A+, A, A-	43.84%	40.47%
SAT score:		
Mean	1017.48	1020.55
S.D.	199.74	208.71
N	*388,437*	*208,122*

Source: SAT data. Public school students only, aged 16-19. Only those who declared school curriculum data and GPA score.

Table 3
Effect of the Mandate on Enrollment Across Subjects

Subjects	States with mandates (%)	States without mandates (%)
Economics:		
Any years	81.94	39.05
0.5 years	58.74	22.78
1+ years	23.20	16.27
Honors program	15.67	6.00
French:		
Any years	27.91	29.24
German:		
Any years	7.17	10.37
Biology:		
1+ years	13.26	16.22
N	*362,457*	*234,102*

Table 4
Effect on SAT Scores of Economics Enrollment

Economics enrollment	Dependent variable: SAT score	
	Coeff.	**(S.E.)**
No Controls for Ability:		
Any years	3.6258	(0.4727)
0.5 years	12.9163	(0.5086)
1+ years	-16.3821	(0.6245)
Honors program	120.2044	(0.6819)
Controls for Ability:		
Any years	-6.7719	(0.4089)
0.5 years	1.2441	(0.4399)
1+ years	-23.9880	(0.5395)
Honors program	63.3224	(0.6139)
N	*596,559*	

Notes: OLS estimation. All variables are statistically significant at 1 percent level. Control variables are: age dummies (3); disability (1); other language (1); US residency (2); ethnicity (3); father's education (5); mother's education (5). The bottom panel also includes 10 dummy variables for High School GPA grade.

Table 5
Effect on SAT Scores of Mandates for Economics

Economics enrollment	Dependent variable: SAT score			
	Mandate (14 states)		Low-regulation mandate (8 states)	
	Coeff.	(S.E.)	Coeff.	(S.E.)
Instrumental variables:[a]				
Any years (IV)	-43.2569	(0.9480)	-89.8370	(1.6076)
0.5 years (IV)	-42.2186	(1.0197)	-91.6641	(1.6948)
1+ years	-48.3607	(0.7490)	-76.0883	(1.0727)
0.5 years	-30.0827	(0.8061)	-72.3547	(1.4635)
1+ years (IV)	-108.0122	(1.8786)	-221.3937	(3.7496)
Honors program (IV)	-190.1430	(4.6536)	-219.1823	(4.1631)
Interaction effects:				
Any years	6.4515	(0.5961)	3.9532	(0.4699)
Any years * mandate	-17.4737	(0.5735)	-22.7819	(0.4947)
0.5 years	16.2462	(0.7269)	13.0975	(0.5308)
1+ years	-7.2914	(0.8330)	-12.6904	(0.6501)
0.5 years * mandate	-18.9978	(0.7296)	-23.8380	(0.5920)
1+ years * mandate	-24.3815	(0.9247)	-27.3597	(0.8696)
Honors program	89.9317	(1.2806)	85.9615	(0.9589)
Honors program * mandate	-33.1600	(1.4007)	-35.6697	(1.1611)
N	*596,559*			

Notes: [a]Estimation in column 1 with mandate status as the instrumental variable for Economics enrollment; Estimation in column 2 with low-regulation mandate status as the instrumental variable for Economics enrollment All variables are statistically significant at 1 percent level. For all equations, control variables are: age dummies (3); disability (1); other language (1); US residency (2); ethnicity (3); father's education (5); mother's education (5); GPA grade (10).

Table 6
Effect on SAT Scores across Subjects

Subject enrollment	Dependent variable: SAT score	
	Coeff.	**(S.E.)**
Economics (any years)	6.1902	(0.7324)
Economics * mandate	-13.4405	(0.8062)
French (any years)	31.4333	(0.7858)
French * mandate	-6.9996	(1.0672)
German (any years)	30.0695	(1.2510)
German * mandate	-1.0614	(1.9023)
Biology (1+ years)	31.6677	(0.9422)
Biology * mandate	3.9691	(1.2870)^{NS}
N	*407,336*	

Notes: All variables are statistically significant at 1 percent level, except where NS= not significant. For all equations, control variables are: age dummies (3); disability (1); other language (1); US residency (2); ethnicity (3); father's education (5); mother's education (5); GPA grade (10).

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